

**CLAIMS**

1. A device for fuel injection rate shaping, characterised in that the device  
5 comprises a body, in which a chamber is arranged, a first channel at the first  
end of the device for the fuel primarily entering the device and a second  
channel at the second end of the device for the fuel primarily leaving the  
device, the first and second channel being in communication with the  
chamber, into which chamber a movable piston is arranged dividing the  
10 chamber into a first main volume and a second main volume, the volumes of  
which depend upon the position of the piston, and further, the device  
comprises at least one auxiliary volume, which can be united with the main  
volumes,

in which device the auxiliary volume can be filled with the fuel  
15 entering the device through the first main volume by utilising the piston  
motion in the first direction,

whereby by utilising the piston motion in the second direction a  
desired pressure can be reached in the auxiliary volume and by establishing a  
connection from the auxiliary volume to the second main volume, whereby a  
20 fuel flow from the auxiliary volume to the second main volume is allowed,  
the piston motion in the second direction can be speeded up.

2. A device according to claim 1, characterised in that said piston, i.e. the  
first piston, is cup-shaped and its middle section is provided with a leading  
25 through, and the cup-shaped side thereof opens toward the first end of the  
device; and further, the chamber of the device includes:

a first resilient means to bias the first piston toward the first end of  
the device;

a channel construction arranged so that one end thereof is  
30 supported by the second end of the device and the other end is located in the  
leading through of the first piston, whereby the first piston is allowed to slide  
with respect to the channel construction;

a second piston, which is cup-shaped and its middle section is provided with a leading through, and the cup-shaped side thereof opens toward the first end of the device, the second piston being located in the cup of the first piston; and

5           a second resilient means to bias the second piston toward said channel construction, whereby the second piston is allowed to slide with respect to the first piston.

10           3. A device according to claim 2, **characterised** in that the channel construction is at least at one point provided with a leading through connection from the channel of the channel construction to the second volume, which consists of a chamber volume defined by the body and the first piston.

15           4. A device according to claim 3, **characterised** in that the leading through of the second piston is in direct communication with the channel of the channel construction while the second resilient means biases the second piston against the channel construction, the channel of which is in communication, via the second volume or directly, with the second channel.

20           5. A device according to claim 2, 3 or 4, **characterised** in that the leading through of the second piston is a choke channel.

25           6. A device according to any one of claims 2 - 5, **characterised** in that the outer side of the second piston is provided with a chamfer or groove forming an auxiliary volume defined by the first and second piston.

30           7. A device according to claim 3 and 6, **characterised** in that the position and motion of the first and second piston are dependent upon the pressure conditions prevailing within the device

so that when the pressure in the second volume is sufficiently lower than that in the first channel, the motion of the first piston is toward

the second end of the device, which motion increases the first volume defined by the body and the pistons at the first end of the device, and at a certain point of the piston motion joins the first volume with the auxiliary volume,

5                   and that while the pressure in the second volume is sufficiently high compared with the pressure prevailing within the first channel, the motion of the first piston is, assisted by the first resilient means, toward the first end of the device,

                  which motion diminishes the auxiliary volume and the first volume  
10               and at a certain point of the piston motion breaks the communication between the first volume and the auxiliary volume, due to which broken communication the pressure in the auxiliary volume makes the second piston move toward the first end of the device disconnecting the second piston from the channel construction, whereby a connection between the auxiliary  
15               volume and the channel of the channel construction is established,

                  and as soon as the pressure is falling in the auxiliary volume, the second resilient means will assist the second piston toward the channel construction, which will break the communication between the auxiliary volume and the channel of the channel construction.

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8. A device according to any one of claims 2 - 7, **characterised** in that the leading through hole or holes are located in the channel construction so that the communication between the first channel and the second channel is broken, when the first piston is at the second end of the device, whereby the  
25               device forms a blockage between the first and second channel.

9. A device according to any one of claims 2 - 8, **characterised** in that the outer edges of the first piston are machined so that they form a support for the resilient means.

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10. A device according to any one of claims 2 - 9, **characterised** in that the body construction is provided with support structures for the resilient means.

11. A device according to any one of claims 2 - 10, **characterised** in that the bottom of the interior of the cup of the second piston is provided with support structures for the second resilient means.

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12. A device according to claim 11, **characterised** in that the resilient means are springs.

10 13. A method for a device for fuel injection rate shaping, **characterised** in that the device comprises a chamber and a movable piston arranged therein dividing the chamber into a first and second main volume, the volumes of which depend upon the position of the piston, and at least one auxiliary volume, which can be united with the main volumes, in which method

15 the auxiliary volume is filled with the fuel entering the device through the first main volume by utilising the piston motion in the first direction,

a sufficient pressure is provided in the auxiliary volume by the piston motion in the second direction and

20 a connection from the auxiliary volume to the second main volume is established for speeding up the piston motion in the second direction, whereby a fuel flow from the auxiliary volume to the second main volume is allowed.

25 14. A method according to claim 13, **characterised** in that the filling of the auxiliary volume with fuel is arranged so that a connection between the auxiliary volume and the first main volume is established at a certain point of the piston motion while the piston is moving in the first direction.

30 15. A method according to claim 14, **characterised** in that a connection between the auxiliary volume and the first main volume is established at the initial moments, when the piston starts its motion in the first direction.

16. A method according to any one of claims 13 - 15, characterised in that a connection between the auxiliary volume and the second main volume is arranged at a certain point of the piston motion while the piston is moving in the second direction.

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